AK

| | **Application No.** | **Applicant(s)** |
|---|---|---|
| **Notice of Allowability** | 10/696,947 | AGILANDAM ET AL. |
| | **Examiner** | **Art Unit** | |
| | Tiffany A. Fetzner | 2859 | |

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address--*
All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *06/07/2005*.

2. ☒ The allowed claim(s) is/are *1-13 with the examiner's ameendment of this action*.

3. ☒ The drawings filed on *07 June 2005* are accepted by the Examiner.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
    a)☐ All   b)☐ Some*   c)☐ None   of the:
        1. ☐ Certified copies of the priority documents have been received.
        2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
        3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the
            International Bureau (PCT Rule 17.2(a)).
    * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☒ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
    (a) ☒ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
        1) ☒ hereto or 2) ☒ to Paper No./Mail Date *08/17/2005*.
    (b) ☒ including changes required by the attached Examiner's Amendment / Comment or in the Office action of
        Paper No./Mail Date *08/17/2005*.

**Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**
1. ☒ Notice of References Cited (PTO-892)
2. ☒ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material

5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date *08/17/2005* .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____ .

## Examiner's Amendment

1.      An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

2.      Authorization for this examiner's amendment was given in a telephone interview with Associate **Attorney Nish Patel for Attorney Patrick W. Rasche Reg. No. 37,916** on August 17th 2005along with authorization to charge any necessary fees to applicant's deposit account number **01-2384**.   However, due to the June 7th 2005 amendment being filed within three months from the March 30th 2005 Office action, Applicant believes that No Fees are currently required.

3.      The application has been amended as follows:

**A)**      **Replace claim 1** of the June 7th 2005 amendment with the following **Examiner amended claim 1:**

**Claim 1**          --- A method **of scanning a volume in an MRI system,** comprising:

        a.      creating a $B_0$ magnetic field;

        b.      creating a $B_0$ map for each slice of a scan volume from the $B_0$ magnetic field, each scan slice having a plurality of positive and negative scan slice pixels;

        c.      obtaining a first frequency of RF pre-pulses for each scan slice;

        d.      **calculating a median value of the $B_0$ magnetic field from the $B_0$ map for each scan slice;**

        e.      calculating percentages of the positive and negative scan slice pixels in each scan slice.---

B)      **Replace claim 2** of the June 7$^{th}$ 2005 amendment with the following **Examiner amended claim 2**:

**Claim 2**       --- A method **of imaging a scan volume in an MRI system,** comprising:

a.      generating a **$B_0$ field map** of each scan slice of a scan volume by measuring a $B_0$ magnetic field over each scan slice of the scan volume, each scan slice having a plurality of positive and negative scan slice pixels;

b.      obtaining a first frequency of RF pre-pulses;

c.      **calculating a median value of the $B_0$ magnetic field over each scan slice, the calculation being done using the $B_0$ field maps;**

d.      calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using the $B_0$ field map for each scan slice, wherein a positive scan slice pixel is defined as a scan slice pixel with positive value in the $B_0$ field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the $B_0$ field map;

e.      wherein when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of:

i.      calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, **the correction for a scan slice being done by using the median value of the $B_0$ magnetic field over the scan slice** calculated at step **c**;

otherwise:

                    ii.       improving shimming of the $B_0$ magnetic field **with a shim** .
**protocol**; and

                    iii.      repeating steps a through e; and

        f.       obtaining an MRI image of each scan slice, wherein the MRI image of a
scan slice is obtained using RF pre-pulses at the second frequency for the scan slice.---

**C)**    **Replace claim 4** of the June 7th 2005 amendment with the following **Examiner
amended claim 4**:

**Claim 4**        --- The method of **claim 1** further comprising applying a plurality of RF
pre-pulses **in order** to suppress magnetic resonance signals from hydrogen nuclei in fat
molecules present in the scan volume. ---

**D)**    **Replace claim 5** of the June 7th 2005 amendment with the following **Examiner
amended claim 5**:

**Claim 5**        --- The method of **claim 1** comprising applying a plurality of RF pre-pulses
are used **in order** to suppress magnetic resonance signals from hydrogen nuclei in
macromolecules present in the scan volume.---

**E)**    **Replace claim 6** of the June 7th 2005 amendment with the following **Examiner
amended claim 6**:

**Claim 6**        --- The method of **claim 1** further comprising applying a plurality of RF pre-pulses are used **in order** to suppress magnetic resonance signals from hydrogen nuclei in water molecules present in the scan volume ---

**F)**     **Replace claim 8** of the June 7$^{th}$ 2005 amendment with the following **Examiner amended claim 8**:

**Claim 8**        ---A method **of imaging a scan volume in an MRI system,** comprising:

a.      generating a $B_0$ field map of each scan slice of a scan volume by measuring a $B_0$ magnetic field over each scan slice of the scan volume and storing the $B_0$ field map in a database, each scan slice having a plurality of positive and negative scan slice pixels;

b.      obtaining a first frequency of RF pre-pulses for each scan slice;

c.      calculating median value of the $B_0$ magnetic field over each scan slice, the calculation being done using the $B_0$ field maps stored in the database;

d.      calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using the $B_0$ field map for each scan slice, wherein a positive scan slice pixel is defined as a scan slice pixel with positive value in the $B_0$ field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the $B_0$ field map;

e.      wherein when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of:

      i.      calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, **the correction for a scan slice being done by adding the median value of the $B_0$ magnetic field over the scan slice** calculated at step **c** to the first frequency of RF pre-pulses calculated at step **b**;

      otherwise:

      ii.      improving shimming of the $B_0$ magnetic field **with a shim protocol**; and

      iii.      repeating steps **a** through **e**;

      f.      obtaining an MRI image of each scan slice using RF pre-pulses at second frequency for that scan slice;

      g.      storing the MRI image of each scan slice obtained at step **f** in the database; and

      h.      displaying the MRI images stored in the database on a display device. ---

**G)**    **Replace claim 9** of the June 7th 2005 amendment with the following **Examiner amended claim 9**:

**Claim 9** . --- The method of **claim 8** wherein the RF pre-pulses are used **in order** to suppress magnetic resonance signals from hydrogen nuclei in fat molecules present in the scan volume. ---

**H)**    **Replace claim 11** of the June 7th 2005 amendment with the following **Examiner amended claim 11**:

**Claim 11**    --- An MRI system comprising:

a.      a polarizing magnet configured to produce a high intensity magnetic field called a $B_0$ magnetic field;

b.      a set of shimming coils configured to improve homogeneity of the $B_0$ magnetic field;

c.      a magnetic field detector configured to measure a $B_0$ magnetic field distribution from the $B_0$ magnetic field;

d.      a set of gradient coils configured to produce a gradient magnetic field superposed on the $B_0$ magnetic field;

e.      a transmitter configured to generate RF pulses and RF pre-pulses wherein frequency of RF pre-pulses is specific for each scan slice, each scan slice having a plurality of positive and negative scan slice pixels;

f.      a radio frequency receiver configured to detect magnetic resonance signals;

g.      a processing module comprising:

i.      a module configured to calculate the median of the $B_0$ magnetic field **distribution map** over each scan slice, **wherein the $B_0$ magnetic field distribution map is generated from the $B_0$ magnetic field distribution**;

ii.      a module configured to calculate percentages of the positive and negative scan slice pixels in each scan slice, wherein positive scan slice pixels are defined as scan slice pixels with positive $B_0$ magnetic field values, and wherein negative scan slice pixels are defined as scan slice pixels with negative $B_0$ magnetic field values;

iii.      a module configured to calculate a second frequency of RF pre-pulses for each scan slice by **adding the median value of a $B_0$ magnetic field**

**distribution map over the scan slice to a first frequency of RF pre-pulses**, the first frequency of RF pre-pulses being obtained by a standard procedure; and

   iv:   a module configured to process magnetic resonance signals from a scan slice **in order** to obtain an MRI image of each scan slice; and

 h.   a database comprising:

   i.   a storage unit configured to store $B_0$ field **distribution** maps;

   ii.   a second storage unit configured to store **the median value of the $B_0$ magnetic field distribution map over each scan slice**; and

   iii.   a third storage unit configured to store an MRI image of each scan slice.---

**l)**   **Replace claim 12** of the June 7$^{th}$ 2005 amendment with the following **Examiner amended claim 12**:

 **Claim 12**   --- A computer program product **configured** for use with a computer, the computer program product comprising a computer usable medium having a computer readable program code embodied therein generating an image **with** an MRI system, the computer program code performing the steps of:

 a.   generating a $B_0$ field map of each scan slice of a scan volume by measuring a $B_0$ magnetic field over each scan slice of the scan volume, each scan slice having a plurality of positive and negative scan slice pixels;

 b.   obtaining a first frequency of RF pre-pulses;

c.      **calculating median value of the $B_0$ magnetic field over each scan slice, the calculation being done using the $B_0$ field maps**;

d.      calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using the $B_0$ field map for each scan slice, wherein a positive scan slice pixel is defined as a scan slice pixel with positive value in the $B_0$ field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the $B_0$ field map;

e.      wherein when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of:

i.      calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the **correction for a scan slice being done by adding the median value of the $B_0$ magnetic field over the scan slice to the first frequency of RF pre-pulses**;

otherwise:

ii.      improving shimming of the $B_0$ magnetic field **with a shim protocol**; and

iii.      repeating steps **a** through **e**; and

f.      obtaining an MRI image of each scan slice, wherein the MRI image of a scan slice is obtained using RF pre-pulses at the second frequency for the scan slice.---

**J)**      **Replace claim 13** of the June 7th 2005 amendment with the following **Examiner amended claim 13**:

**Claim 13**      --- A computer program product **configured** for use with a computer, the computer program product comprising a computer usable medium having a computer readable program code embodied therein acquiring an image **with** an MRI system, the computer program code performing the steps of:

a.      generating a $B_0$ field map of each scan slice of a scan volume by measuring a $B_0$ magnetic field over each scan slice of the scan volume and storing the $B_0$ map in a database, each scan slice having a plurality of positive and negative scan slice pixels;

b.      obtaining a first frequency of RF pre-pulses for each scan slice;

c.      **calculating median value of the $B_0$ magnetic field over each scan slice, the calculation being done using the $B_0$ field maps** stored in the database;

d.      calculating percentages of the positive and negative scan slice pixels in each scan slice, the calculation being done using the $B_0$ field map for each scan slice, wherein a positive scan slice pixel is defined as a scan slice pixel with positive value in the $B_0$ field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the $B_0$ field map;

e.      wherein when the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of:

i.      calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, **the correction for a scan slice being done by adding the median value of the $B_0$ magnetic field over the scan slice to the first frequency of RF pre-pulses;**

otherwise:

        ii.     improving shimming of the $B_0$ magnetic field **with a shim protocol**; and repeating steps **a** through **e**;

        f.     obtaining an MRI image of each scan slice using RF pre-pulses at second frequency for that scan slice calculated at step **e**;

        g.     storing the MRI image of each scan slice obtained at step **f** in the database; and

h.     displaying the MRI images stored in the database on a display device. ---

The following is an examiner's statement of **Reasons for Allowance**:

4.     With respect to **examiner amended Independent claims 1, 2, 8, 11, 12**, and **13** Each of these claims are considered to be allowable over the **prior art of record** because the **prior art of record does not disclose or suggest** <u>an MRI method or system where the limitation of calculating a median value of the $B_0$ magnetic field from the $B_0$ map for each scan slice</u>; is used <u>in combination with each of the other limitations in each of the **examiner amended independent claims**</u>. In each of the **examiner amended independent claims**, all of the other limitations with the exception of applicant's calculation of a median value of the $B_0$ magnetic field from the $B_0$ map for each scan slice; is met, taught, or found within the prior art of record. **It is the specific application of the median value of the $B_0$ magnetic field from the $B_0$ map for each scan slice that constitutes both the novelty and non-obviousness of applicant's claims**, <u>since in all of the prior arts an "average", or "mean value", but not applicant's median value is applied. The "median" value is not equivalent to a "mean" or "average" value.</u> Because a median value is not an average or mean, applicant's method is novel over the **prior art of record**. It is also non-obvious because the prior-art of record do not even consider the affect of applying a median value to each slice of a $B_0$ magnetic field from a $B_0$ magnetic field map. Therefore applicant's method teaches away from what is taught in the prior art.

5.      Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

## Examiner's Comment

### *Drawings*

6.      The Replacement drawings submitted June 7th 2005 have been objected to by the Official draftsperson. [See the attached PTO 948 form] New Formal Drawings in Accordance with the Official Draftsperson's Requirements are now needed.

### Response to Arguments

7.      Applicant's arguments, see pages 13-24 of the June 7th 2005 amendment, with respect to **claims 1-13** have been fully considered and are persuasive. The rejections of the March 30th 2005 office action has been withdrawn. However, the amendment and response of the June 7th 2005 amendment does not place the instant application in condition for allowance by itself because the amendment still contained antecedent problems, and grammatical issues with respect to the claims. **In combination with the examiner's amendment above however the application is allowable over the prior art of record.** The examiner's amendment is free of new matter because the amendments made above only clarify proper antecedence, resolve grammatical concerns and resolve the remaining formal matter issues without adding new matter.

8.      The **prior art made of record** and not relied upon is considered pertinent to applicant's disclosure.

A)      **Zhou et al.**, US patent 6,064,205 issued May 16th 2000.

B)      **Froundlich et al.**, US patent 6,559,644B2 issued May 6th 2003, filed May 30th 2001. [This reference teaches using Median as opposed to mean measurements to determine a correction frequency when the concern is static magnetic field drift.[See col. 5 lines 12-17; col. 5 lines 25-43; col. 5 lines 53-60; col. 6 lines 3-9; col. 1 lines 53-55].

C)      **Froundlich et al.**, US patent application publication 2002/0180438 A1 published December 5th 2002, filed May 30th 2001 which corresponds to **Froundlich et al.**, US patent 6,559,644B2 issued May 6th 2003, filed May 30th 2001. [This reference also

teaches using Median as opposed to mean measurements to determine a correction frequency when the concern is static magnetic field drift.

**D)**    **Kaufman et al.**, US patent 4,970,457 issued Nov. 13$^{th}$ 1990, which cites the **Yao et al.**, reference applied above.

**E)**    **Wicklow et al.**, US patent 6,515,478 B1 issued Feb. 4$^{th}$ 2003, filed June 29$^{th}$ 2000.

**F)**    **Yao et al.**, US patent 4,885,542 issued December 5$^{th}$ 1989. [See applicant's arguments on pages 14-24 of the June 7$^{th}$ 2005 amendment.]

**G)**    **Kruger et al.,** US patent application publication 2005/0033156 A1 published Feb. 10$^{th}$ 2005, filed July 8$^{th}$ 2004. This reference is not prior art against the claims because a) a phase average of a middle line of the k-space B0 map is not equivalent to a "median" of a B0 map for each slice as claimed by applicant, and b) applicant's filing date is before the US filing date of this reference. The examiner cannot consider the German priority date of this reference, because the foreign German application is not in English, and does not meet the criteria of designating the United States.

## Conclusion

9.    Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

10.    If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(703) 872-9306.**

TAF
August 17, 2005

Diego Gutierrez
Supervisory Patent Examiner
Technology Center 2800